NAVAL POSTGRADUATE SCHOOL
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THESIS

A DATABASE OF ADVERSARY DECISION MAKERS

by

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March 2001

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Advances in database and decision technologies provide abundant opportunities for implementing decision support systems for Information Operations specialists. This thesis describes, designs, and partially implements a system that provides information about adversary decision makers and the media they access. The Adversary Decision Maker Systems (ADMS) consists of a relational database and associated user interface of forms and reports, implemented in Microsoft Access™. The database design and development process is elaborated in detail, database administration guidelines are documented, and a migration path is presented for incorporating relevant decision support tools to augment the database. A decision support system, the Situational Influence Assessment Module (SIAM), which is based upon influence diagrams and belief networks, is used to demonstrate how the database and decision technologies can be integrated. The ADMS developed in this thesis meets the requirements of USPACOM, yet is general enough to be used for any theater commander's Area of Responsibility (AOR).

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A DATABASE OF ADVERSARY DECISION MAKERS

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ABSTRACT

Advances in database and decision technologies provide abundant opportunities for implementing decision support systems for Information Operations specialists. This thesis describes, designs, and partially implements a system that provides information about adversary decision makers and the media they access. The Adversary Decision Maker Systems (ADMS) consists of a relational database and associated user interface of forms and reports, implemented in Microsoft Access™. The database design and development process is elaborated in detail, database administration guidelines are documented, and a migration path is presented for incorporating relevant decision support tools to augment the database. A decision support system, the Situational Influence Assessment Module (SIAM), which is based upon influence diagrams and belief networks, is used to demonstrate how the database and decision technologies can be integrated. The ADMS developed in this thesis meets the requirements of USPACOM, yet is general enough to be used for any theater commander's Area of Responsibility (AOR).

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I. INTRODUCTION

A. BACKGROUND

The Information Operations (J39) shop at USPACOM in Camp Smith, Hawaii expressed an interest in developing a database that would track the sources of information input to adversary decision makers in the Pacific theater Area of Responsibility (AOR). For example, do North Korean leaders read USA Today? Or do Chinese leaders surf the Internet? This information is directly tied to the "observe" phase of the adversary's observe-orient-decide-act (OODA) loop. Obviously knowing what the adversary is observing is a big help to our theater Commanders-in-Chief (CinCs) when they are deciding how to affect the adversary OODA process. The current problem is, though some of this information may be known, it is currently scattered among various PACOM resources and is not at the immediate fingertips of the theater CinCs. The information is not tracked in an efficient manner and is not in a format that can be easily attained to make quick decisions.

Attacking this problem with a database solution provides a storage location to keep relevant information, and provides an efficient tracking device that formats the data making it easily accessible to the Pacific theater CinC. The completed database will give the CinC a mechanism for conducting appropriate Information Operations during peacetime as well as contingency operations.

Since all theater CinCs have similar situations regarding their current posture in this matter, this solution can be applied to all theaters. Generally speaking, the shell of the database will be the same in all theaters and the data will vary. This thesis will provide a database shell for all theater CinCs and the utility of the database will be proven in a prototype database developed using PACOM data.

Just as current database technology will provide a useful solution to USPACOM's problem, there are tools available today that provide support to decision making. Use of a Decision Support System (DSS) along with this database will greatly enhance the speed and quality of decisions made with respect to the data stored in this database. The possibility of using a DSS in conjunction with this database will be discussed but not developed in this thesis.

B. PURPOSE

The purpose of this thesis is to prove that database technology is an appropriate solution to USPACOM's problem and that other theater CinCs can easily develop a database applicable to their own AOR using the shell created in this project. USPACOM will be provided with a prototype database for Adversarial Decision-making in the Pacific Theater AOR and other CinCs will have a structure with which to build a database specific to their AOR. CinCs will have an efficient mechanism for conducting appropriate Information Operations during peacetime and contingency situations.

C. SCOPE AND METHODOLOGY

The scope of this thesis will include: (1) a concise review of Database Technology, (2) an overview of the database requirements generated from interviews

with USPACOM personnel, (3) data compiled from USPACOM resources about information sources (media) utilized by adversaries, (4) a prototype database storing and displaying this data, and (5) an analysis on appropriate decision support tools for this database. This thesis will address unclassified media only (i.e. – television, radio, newspapers, and magazines) and will not address how adversaries utilize information attained from SIGINT and other Intelligence sources.

The methodology used in this thesis research will consist of the following steps:

1. Conduct a thorough review of database technology and specifically the use of Microsoft Access, which will be used to build the prototype for USPACOM.
2. Elicit requirements from the Information Operations Shop at USPACOM.
3. Elicit data requirements for each high priority country in the USPACOM AOR to include key decision-makers, what media sources they use, how they use it, and the credibility of each source using USPACOM resources such as theater target specialists (data collection/interviews), and various websites.
4. Create a database shell using data fields that emerge from research and discussions, and which fulfill USPACOM requirements. This shell will be general in nature so that it can, in principle, be used by any theater CinC.
5. Build a prototype database using the shell developed in step 5 and the compiled theater data for use by USPACOM.
6. Review and analyze decision support tools that can utilize the data in the Database. The specific decision technology that will be looked at will be influence diagrams.

D. ORGANIZATION OF THE THESIS

The following chapters in this thesis provide a discussion on database technology and how it should be implemented for this particular problem. It is organized as follows.

Chapter II is a concise overview of database technology. It includes current database options as well as a short analysis on which option is best for this application.

Chapter III outlines the various database requirements as defined by USPACOM and other theater CinCs and the database system is developed using these requirements.

Chapter IV walks through the implementation of the system. Forms to populate the database will be created along with the queries that will be used to generate the reports the system will be expected to provide.

Chapter V discusses decision support tools that can be used to analyze the data and provides analysis on the possibility of using a decision support system with this database.

Chapter VI provides a conclusion along with recommendations for further work on this project.

E. DISCLAIMER

The information generated from this system could be used in support of both friendly and adversary Information Operations. The use of any country or decision-maker in this thesis is for example purposes only and does not indicate any official position of the United States Government regarding the status of the country or the decision-maker.

II. OVERVIEW OF DATABASE TECHNOLOGY

A. INTRODUCTION

Prior to deriving the specific requirements for this database, it is important to understand the database technology landscape, including what options are currently available to database users today. In addition, it must be determined which of these options is the most appropriate selection for this particular case. This chapter will provides a concise review of relevant database concepts, an overview of options available to database users, and an application selection summarization.

B. REVIEW OF RELEVANT DATABASE CONCEPTS

A database is a collection of data that is organized so that its contents can be easily accessed, managed, and updated. Data in a relational system is stored in a tabular format. More specifically, a relational database is a collection of data items organized as a set of formally-described tables from which data can be accessed or reassembled in many different ways without having to reorganize the database tables. Figure 1 on the following page is an example of a relational database.

A Relational Data Base

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267-41-2394	TC7777
274-80-9391	BU7832
409-56-7008	BU1032
427-17-2319	PC8888
472-27-2349	TC7777

Figure 2-1: Example of Relational Database

There are many software applications that can be utilized to design, build, and implement a database. Some of these will be discussed in a later section. In the database design phase, there are five steps.

- Planning and analysis
- Conceptual design
- Logical design
- Physical design
- Implementation

Each phase will be described in the following sub-sections with heavier emphasis on the Planning and Analysis and Conceptual Design phases since these are regarded as two of the more important aspects of database design. Using the analogy of building a house, it is important that the foundation be laid correctly or the integrity of the structure will be in question. For database design, the foundation consists of defining the requirements and building a proper data model. If this is not done correctly, the database cannot be expected to function as a useful tool for the user.

1. Planning and Analysis

The planning and analysis phase deals with the specifications of user requirements. The objective of this phase is to define what the database is expected to do. [Maciaszek 53] Before a database can be designed and developed, certain information must be obtained which will be used to drive the design phase. This critical information is gathered through requirements analysis. The goals of requirements analysis are:

- To determine the data requirements of the database in terms of primitive objects.
- To classify and describe the information about these objects.
- To identify and classify the relationships among the objects.
- To determine the types of transactions that will be executed on the database and the interactions between the data and the transactions.
- To identify the rules governing the integrity of the data.

This information can be gathered in several ways. Most commonly, information is obtained by reviewing existing documents and by interviewing end users. If a database already exists, another method would be to study the current system. In this case, there is no current system in existence to examine.

2. Conceptual Design

There are two models that make up the Conceptual phase. The Data Model and the Function Model are each described below.

a. *The Data Model*

A data model is a conceptual representation of the data structures that are required by a database. The data structures include three things: 1) the data objects, 2) the associations between data objects, and 3) the rules that govern operations on the objects. A data model is analogous to an architect's building plans or 'blueprints.' Just as it would be unwise for an architect to build without blueprints, it is equally unwise for a database developer to build a database without a data model. The data model focuses on representing the data as viewed by the user (vice the database) in the real world and

serves as a bridge between the concepts that make up real world events and the physical representation of those concepts in a database. A useful data model should be simple enough to be understood by the end-user, yet it must provide enough details so it can be used as a 'blueprint' by the developer for building the physical database.

There are two frequently used methodologies for creating data models: the Entity-Relationship (E-R) Model and the Semantic Object Model. The two methodologies are similar in that they are both tools for understanding and documenting the structure of users' data. They both strive to model the structure of the things in the users' world and the relationships among those things.

The primary difference between the two models is one of orientation. The E-R Model is the most common method used to build data models for relational databases and it views the real world as a construct of entities and association between those entities. The Semantic Object Model, on the other hand, uses the set of semantic objects as a map of the essential structure of things that the user sees as important. [Kroenke 102] The set of objects in a data model represents the structure of things about which a user wants to collect information. This project will utilize the Semantic Object Model for development of the data model. The following section provides a more detailed description of the Semantic Model.

The Semantic Object Model

The Semantic Object Model consists of objects and the relationships that exist between them. An object is a principal data item about which information is to be collected. They are usually recognizable concepts such as persons, places, things, or

events that have relevance to the database. An object in the Semantic Object Model translates to a table in the relational model. A relationship in the Semantic Object Model is an association between two or more objects.

Attributes are used to describe objects. Keys are a type of attribute that uniquely identifies an instance of an object (An instance would be an individual occurrence of an object and is analogous to a row in the relational table). Each object must have a primary key that uniquely identifies individual instances of that particular object. In order to be designated as a primary key for an object, an attribute must meet the following requirements:

- It must have a non-null value for each instance of the object.
- The value must be unique for each instance of the object.
- The values must not change or become null during the life of each instance.

Figure 2 depicts an example of a Semantic Object Model diagram and shows all of the concepts outlined above.

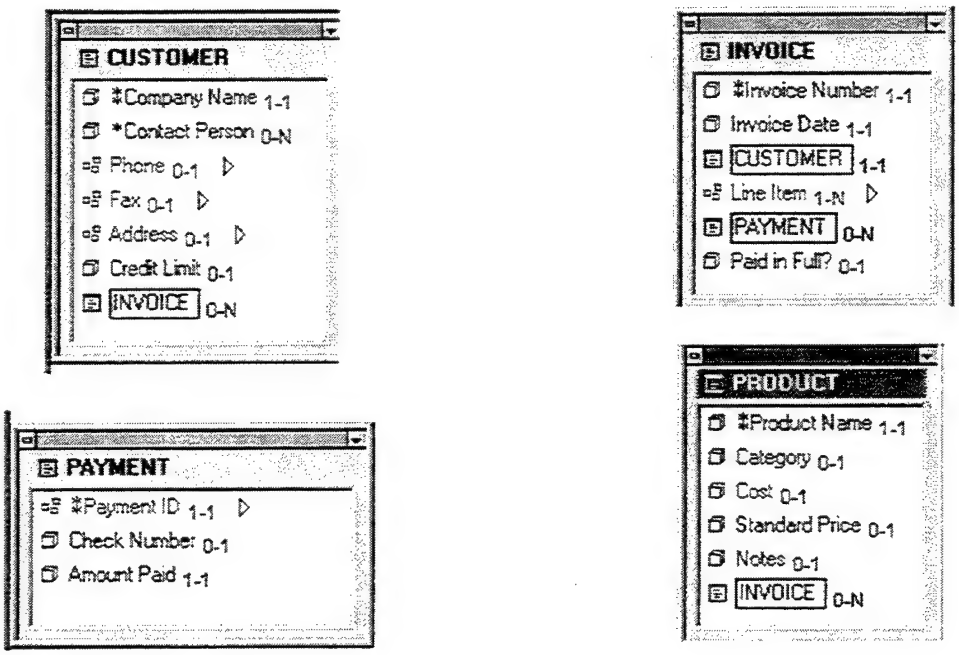

Figure 2-2: Example of Semantic Object Model

b. *The Function Model*

While the data model focuses on what data should be stored in the database, the function model focuses on how the data is processed. Stating this in the context of the relational database, the data model is used to design the relational tables, while the functional model is used to design the queries that will access and perform operations on those tables. The question to be answered here is, "What do you want the database to show you or provide to you?" The functional model outlines the answers to this question in as much detail as possible. Using this model, queries will be constructed to perform operations such as adding/deleting items to/from the database, updating information, and providing reports.

The two models in the conceptual design phase are built using input from the planning and analysis phase and, when performed correctly, provide a solid foundation with which to build the database. It is essential that the proper time and energy be devoted to these areas during the design process to ensure that a viable product will result.

3. Logical Design

From the Conceptual design, primarily the ER diagram, the Logical design of the database can be derived automatically. Once the logical design is developed, it is subjected to normalization. Normalization is the process of organizing the database into tables in such a way that the results of using the database are always unambiguous and as intended. Normalization sometimes has the effect of increasing the duplication of data items and quite often results in the creation of additional tables. Currently, there are five levels of normalization defined. Each level satisfies a different set of constraints Tables 1, 2, and 3 show an example of normalizing data.

S#	Status	City	P#	Qty
S1	20	Atlanta	P1	3000
S1	20	Atlanta	P2	2000
S1	20	Atlanta	P3	4000
S1	20	Atlanta	P4	2000
S1	20	Atlanta	P5	1000
S1	20	Atlanta	P6	1000
S2	10	Los Angeles	P1	3000
S2	10	Los Angeles	P2	4000
S3	10	Houston	P2	2000
S4	20	Chicago	P2	2000
S4	20	Chicago	P4	3000
S4	20	Chicago	P5	4000

Table 2-1: Example of Normalization

S#	Status	City
S1	20	Atlanta
S2	10	Los Angeles
S3	10	Houston
S4	20	Chicago
S5	30	New York

Table 2-2: Example of Normalization

P#	S#	Qty
P1	S1	3000
P1	S2	3000
P2	S1	2000
P2	S2	4000
P2	S3	2000
P2	S4	2000
P3	S1	4000
P4	S1	2000
P4	S4	3000
P5	S1	1000
P5	S4	4000
P6	S1	1000

Table 2-3: Example of Normalization

In Table 1, notice that the following update anomalies are present:

- Supplier S5 is located in New York but cannot be added until they supply a part.
- If a row is deleted, information is lost about quantity, part, and supplier.
- If supplier S1 moved from Atlanta to Charlotte, six rows would have to be updated with the new information.

When Table 1 is divided into Tables 2 and 3, these anomalies are fixed though others exist. In this example, further normalization should occur to reduce the amount of

anomalies. However, the example clearly shows the process of normalization and why it is important.

4. Physical Design

Physical characteristics of data tend to be hidden from the user in relational models. As database technology has improved through the years, designers are given less opportunity to control physical aspects of a relational database. The goal of physical database design is performance. A good physical design minimizes the number of input/output transfers and makes efficient use of external and virtual storage [Maciaszek 246]. Storage, access paths, and processing efficiency are all important aspects in meeting the performance objective. Since today's database management systems essentially take care of these issues for us, they will not be discussed any further for the purposes of this project.

5. Implementation

The final phase of the design phase, implementation, is actually creating the database and all of the functions that will be used with it. This involves creating the tables that will store the data, defining the relationships among the tables, and creating queries, forms and reports.

Queries, generally, are questions posed to the database to extract certain data. They are used as the basis for forms and reports. A form is a computer screen display used to present, enter, and modify data. A report is an extraction of data from a database. They can be printed, displayed or stored. Queries must be structured in a language that

can be understood by the database management application. The most widely used language for this purpose is known as Standard Query Language (SQL).

C. DATA MINING/WAREHOUSING, AND INFLUENCE DIAGRAMS

Three technologies that will aid in the development of a follow-on associated decision support system for this project include data mining, data warehousing, and influence diagrams. These technologies will be briefly introduced here, and then relevant issues pertaining to them will be discussed in greater detail along with suggestions for implementation in Chapter V.

Data mining is the analysis of data for relationships that have not previously been discovered. The results of data mining include the following:

- Associations – when one event can be correlated to another event.
- Sequences – when one event leads to another later event.
- Classification – recognition of patterns resulting in a new organization of data.
- Clustering – Finding and visualizing groups of facts not previously known.
- Forecasting – discovering patterns in the data that can lead to predictions about the future.

Due to the possibilities of successful data mining, the data warehouse concept is gaining more and more acceptance as a viable option for decision support systems and database developers. A data warehouse is a store of enterprise data that is designed to facilitate management decision-making. It includes not only data, but also tools, procedures, training, personnel, and other resources that make access to the data easier and more relevant to decision-makers. The goal of the data warehouse is to increase the

value of the organization's data asset [Kroenke, 382]. Additionally, data warehousing allows users to define multiple dimensions by which to drill-down through data to get very specific, or conversely, highly aggregated information.

Once a decision-making problem has been analyzed, understood, and defined, one or more models are often constructed to provide decision alternatives to users. One class of models that is used frequently for this purpose is influence diagrams. Influence diagrams are used to map the structural design of a model. An influence diagram is a graphic representation of a model used to assist in model design, development, and understanding. It provides visual communication to the model developer(s), and serves as a framework for expressing the exact nature of model relationships [Turban, 150]. An influence diagram is similar to a flowchart, which is used as a design tool to graphically represent the flow of a computer program.

D. CURRENT DATABASE OPTIONS

There are many database products that can be used to meet the requirements for this project. However, a few of the more prominent applications will be introduced in this section in order to give the user brief familiarity with a some of the database options that exist today. All of the following options are desktop database products and will be the only type considered for this project.

1. Ingres II

Ingres II is a relational database management system that runs on Windows NT, Linux, and most Unix platforms. Like many of the relational database management system applications currently available, Ingres has begun to add object-oriented

development features to address the growing paradigm shift in this market towards more object-oriented database management systems. It uses Structured Query Language as its language for queries and database transactions.

2. InstaBase 4.0

InstaBase allows users to easily design any kind of database and publish it to the web. Therefore, multitudes of information can be shared with others through the web using an on-line database. InstaBase uses java technology so it can be run on any platform and viewed by anyone.

3. Microsoft Access 2000

Microsoft Access is one of the more popular relational database management systems for creating desktop and client/server database applications. It runs under the Windows operating system and is relatively easy to use. The 2000 version includes powerful tools for managing data and allows users to share their databases with others through an intranet. It allows for quick search and retrieval of information, and automated pre-packaged solutions help to quickly create new databases. Access supports SQL for development of queries.

4. Salsa for the Desktop

Salsa uses the Semantic Object Model vice the Entity-Relationship Model for database development. Database applications with SALSA, for the Desktop, are created by designing a model of the items to be tracked. The model simply describes the data. Using this model, SALSA for the desktop will create the database application. It runs on

the Windows operating system and can be used with other database management systems such as Microsoft's Access.

E. APPLICATION SELECTION

Table 4 shows the products discussed in the previous section and the criteria used to aid in the selection of an application to be used for this project. It is meant to give the reader a visual graph of the selection criteria so that the selection process can be easily understood.

	← Selection Criteria →			
Products	**Ease of Use (0,1,2)**	**Uses SQL**	**Runs on Windows OS**	**IT-21 Compliant**
Ingres II	1	Yes	Yes	No
Access 2000	0	Yes	Yes	Yes
Instabase 4.0	0	Yes	Yes	No
Salsa	1	Yes	Yes	No

Table 2-4: Database Product Selection Criteria

The selection of an application to use for this project takes into consideration the quality of the current options available, as well as the climate in which this database is to be used. Because of these considerations, Microsoft Access 2000 is best suited for the development of this database. Access is one of the more common Database Management Systems, is easy to use, and can be learned in a short amount of time. Most, if not all, military personnel are already familiar with the Microsoft Windows operating environment of which all Microsoft Office applications utilize. At the present time, Access 2000 is the latest version of Access and is fully deployed and fully capable. Even

though this will be used in the joint environment, IT-21 standards call for the utilization of Microsoft Office products; therefore Access 2000 is the logical choice to avoid joint-interoperability issues in the future.

F. DECISION SUPPORT TOOL SELECTION

This project is being developed in conjunction with other follow-on projects, which will all integrate to become one system, and takes into consideration the implementation issues of the big picture. Because of this, a tool called Situational Influence Assessment Module (SIAM) will be introduced in Chapter V as a decision support technology that can analyze the information in the database using influence diagrams to suggest decisions that could be used to benefit theater interests.

G. CHAPTER CONCLUSION

With a better understanding of some basic database concepts and technologies, we now focus on the design of the system. The development begins in Chapter III with a discussion and analysis of the project requirements. These requirements will be used to develop the data model, which leads to the creation of database tables.

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III. SYSTEM REQUIREMENTS ANALYSIS AND DESIGN

A. INTRODUCTION

Requirements analysis is the first and most important aspect of building a database. It is a major part of the foundation on which the database will rest. During the requirements analysis phase, information that details what the database will be expected to do is collected from users. This critical information includes what reports and queries the users desire, what data is to be stored in the database, what types of functions the database will perform, and what kinds of security and access mechanisms will be implemented. For new database applications, requirements information is obtained primarily through an interview process with users, and focuses on reports that must be generated by the application.

The system being developed from this point forward will be referred to as ADMS, which is an acronym that stands for Adversary Decision Makers System. ADMS will be expected to store information on many countries and how these countries attain and use information from such unclassified media sources as newspapers, magazines, and television. Countries will be broken down into specific key decision-makers. Functionally, the database should be able to provide reports on such things as which media sources are most commonly used by a certain country, which decision-makers can be influenced by certain media sources, etc. These reports will be very useful when conducting theater Information Operations.

B. REQUIREMENTS

1. Reports

There are several reports that are expected to be provided by ADMS. These reports will provide the output of important data in the system in a form that is easy to read and understand, and will help CinCs in making important decisions regarding Information Operations. An example of each report type is provided in this section along with the query that will retrieve the data for the report.

The first five reports simply display general information in the form of lists about each of the main objects. These objects include Country, Decision-Maker, Media Source, Alliance, and Affiliation. Figure 3-1 shows an outline of the report that lists all of the countries in ADMS. It provides the name, priority, and type of government for each country in the system.

ADMS Report

All Countries

Name	Priority	Gov't Type

Figure 3-1: Sample Report

Figure 3-2 shows an outline of the report listing all of the decision-makers in ADMS. It provides the name, title, and country for each decision-maker in the system.

ADMS Report

All Decision-Makers

LName	FName	Title	Country

Figure 3-2: Sample Report

Figure 3-3 shows an outline of the report listing all of the media sources in ADMS. It provides the name, location, media type, and periodicity for each media source in the system.

ADMS Report

All Media Sources

Name	Location	Type	Periodicity

Figure 3-3: Sample Report

Figure 3-4 shows an outline of the report that listing all of the alliances in ADMS. For a specific country selected by the user, it provides the ally and the ally's type of government for each of that country's alliances stored in the system.

ADMS Report

All Alliances for Thailand

Ally	Govt Type

Figure 3-4: Sample Report

Figure 3-5 shows an outline of the report listing all of the affiliations in ADMS. For a specific country selected by the user, it provides the organization and type of affiliation for each of that country's affiliations stored in the system.

ADMS Report

All Affiliations for Japan

Organization	Affiliation Type

Figure 3-5: Sample Report

The rest of the reports dig deeper into the data to provide information that shows relationships among the entities within the system which can be analyzed and possibly used to suggest what actions can be taken in given situations. For example, we can

display all decision-makers in ADMS that use a specific media source. Figure 3-6 provides an outline of what this type of report should look like. It displays the name, title, and country for all decision-makers in ADMS that use a specific media as a reliable source.

ADMS Report

Decision-Makers that use Newsweek magazine

LName	FName	Title	Country

Figure 3-6: Sample Report

Now, we can take that report a step further by "drilling down" a little more in the data. Figure 3-7 shows a similar report as in Figure 3-6, except that we now specify a country. Figure 3-7 shows a sample report listing all decision-makers in a specific country that use a specific media source. The report shows the name and title of each decision-maker in ADMS that fit this criterion.

ADMS Report

Decision-Makers in North Korea that use USA Today

LName	FName	Title

Figure 3-7: Sample Report

Figure 3-8 is an example of a report showing all of the media sources in the systems that are used by a particular country. The report shows the name, type of media source, and periodicity for each media source in ADMS that is used by a particular country.

ADMS Report

Media Sources used by Japan

Name	Location	Type	Periodicity

Figure 3-8: Sample Report

Figure 3-9 is an example of a report showing all of the countries in the system that uses a particular media source. The report shows the country, leader, and type of government for each country in ADMS that use a particular media source.

ADMS Report

Countries that use CNN

Country	Leader	Govt Type

Figure 3-9: Sample Report

Figure 3-10 is an example of a report showing all of the alliances in the systems that are with a particular government type. The report shows the ally and type of government for all alliances in ADMS that are with a particular type of government.

ADMS Report

All Alliances for China with Communist Governments

Ally	Govt Type

Figure 3-10: Sample Report

Figure 3-11 is an example of a report showing all of the affiliations of a particular type for a particular country. The report shows the organization, and type of affiliation for each affiliation listed in ADMS of a particular country and of a particular type.

ADMS Report

All National Affiliations for Russia

Organization	Affiliation Type

Figure 3-11: Sample Report

2. Functional Requirements

The functions that this database will be expected to perform will provide users a clear understanding of the data which will, in turn, enable theater CinCs to choose appropriate and effective Information Operations whenever necessary. A database full of data is grossly ineffective without proper functionality. It must be determined what data should be extracted from the database in order to receive specific information in a form that is useful to the end-user. The data will be retrieved from the database in the form of queries. The functional requirements outline the information that the database will be expected to provide.

The basic functional requirements for this project are as follows:

- Allow users to add, delete, or change data in the database using forms.
- Provide a report of all decision-makers that use a specific media source.
- Provide a report of all countries that use a specific media source.
- Provide a report of all media sources used by a specific country.
- Provide a report of all alliances for a particular country.
- Provide a report of all affiliations for a particular country.

In addition, there should be a capability for users to drill down through the data to get down to very specific information. For example, Affiliations can be categorized into National, Trans-National, and Organizational. Users may first want to see all affiliations for a particular country. Of that set, they can ask to see all Trans-National Affiliations for that country and a new table will appear. Of that set, they can ask to see all Trans-

National Affiliations for that country with a certain organization. The drilldown categories for ADMS are as follows:

1) All alliances

>>All alliances for a specific country

>>All alliances for a specific country where the ally has a specific government type.

2) All affiliations

>>All affiliations for a specific country

>>All affiliations for a specific country with a specific type of affiliation.

3) All media sources

>>All media sources for a specific country

>>All media sources of a specific type for a specific country.

4) All decision-makers

>>All decision-makers for a specific country

>>All decision-makers for a specific country who use a specific media source.

These functional requirements and drill-down categories allow users to "slice and dice" the data as necessary while providing potentially valuable information that can be analyzed and possibly used to determine what Information Operations actions may be effective.

3. Decision Support System (DSS) Requirements

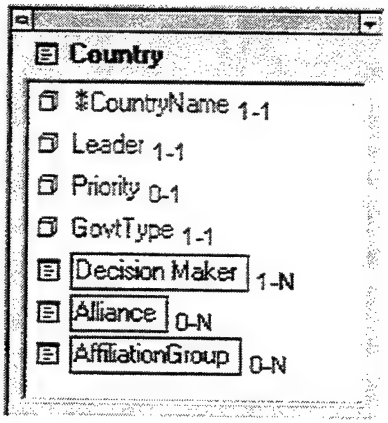
With the database as a foundation, ADMS can utilize appropriate decision support tools to analyze the data contained in the system and contribute towards informed decisions with respect to Information Operations. These decisions will be influential in nature. Once we know who the key decision-makers are and how they are influenced, appropriate actions can be taken, if they are deemed necessary, in a given situation. The DSS component should take inputs from the database as well as other factors such as current political environment, military capabilities, and logistical constraints to aid CinCs in deciding what actions to take. This component will be discussed in Chapter V, but will not be implemented as a part of this project.

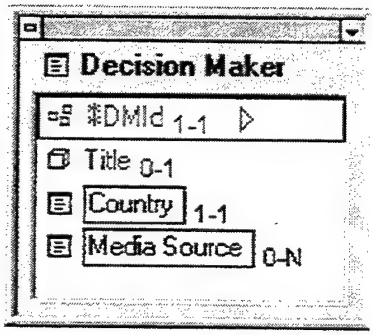
4. Security and Access Requirements

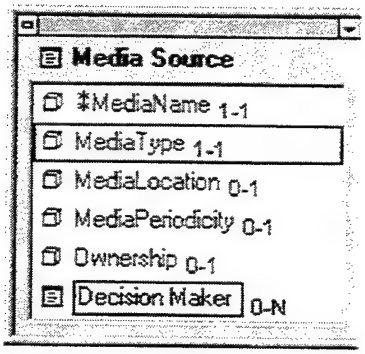
The data that will be contained in ADMS is sensitive and therefore will require a secure system as well as access constraints. Once ADMS is populated with data, it's classification will likely become SECRET and must be treated as such. Access to, and modification of, the data must be limited to those with the appropriate clearance and access privileges to complete tasks related to their jobs. A password system will be implemented to prevent unauthorized access to ADMS and all security measures should be strictly adhered to and enforced to avoid disclosure of ADMS information. Database encryption is another option depending on where the database will reside and whether or not it will be shared.

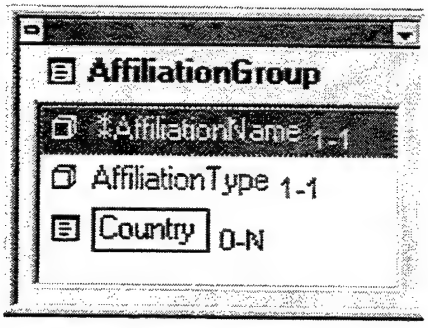
C. DATA MODEL

The next step in the design of ADMS is to use the requirements outlined above to create a data model. This model will provide a blueprint of the entities and how they relate to one another enabling an easy transition to the actual development of the database tables. The data model for ADMS uses a semantic object model representation, which is consistent with the object-oriented approach to systems development that characterizes contemporary information systems development. The ADMS semantic object model is shown in Figure 3-12. The objects and relationships in this model are described in Appendices A, B, and C.









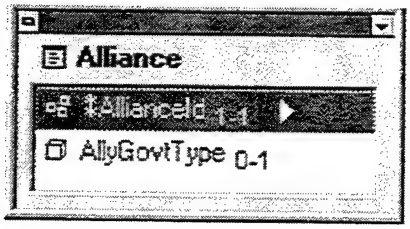


Figure 3-12: ADMS Semantic Object Model

D. DATABASE STRUCTURE

1. Tables and Relationships

Using the data model developed in the previous section, tables can then be generated automatically in Microsoft Access 2000. Subsequently, a relationship model is created displaying all of the tables and their relationships. This model represents the database schema and is shown in Figure 3-13.

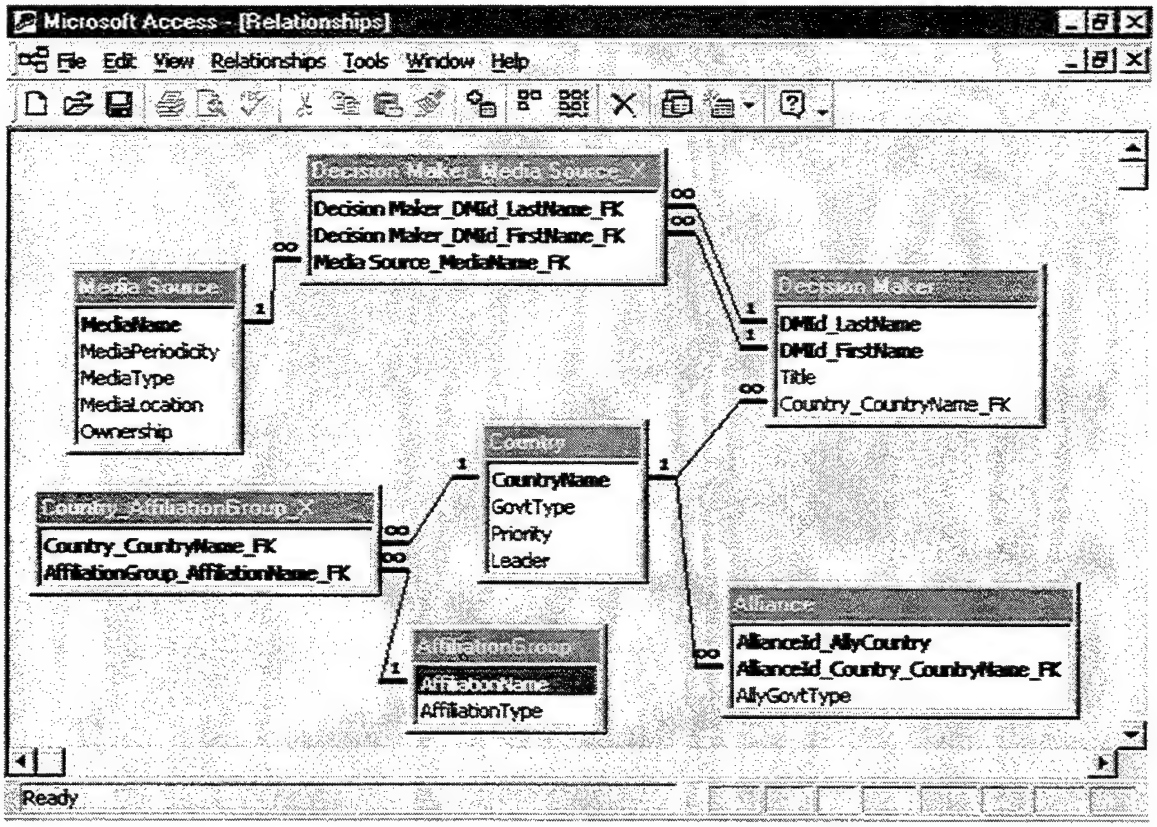


Figure 3-13: ADMS Relationships

The tables along with their relationships provide the structure of ADMS. Now the database is ready for implementation. Forms can be created to populate the database, queries can be formally developed, and the reports shown earlier can be designed. This implementation phase of the development will be presented in Chapter IV.

2. Tables and Attributes

This section discusses the data tables generated for ADMS. The following narrative enumerates a data dictionary that will describe the attributes for each table. The data that will be required to build this database and make it useful is quite extensive. Seven (7) tables form the basis of ADMS: *Country, Decision Maker, Media Source, Alliance, Affiliation, Country_AffiliationGroup_X,* and *DecisionMaker_Media_Source_X.*

The first table, *Country*, contains adversarial countries in the theater's Area of Responsibility (AOR). In the case of USPACOM, there are more than forty instances of potentially adversarial countries. However, six countries have been selected as the top priorities in this AOR, and these six countries will be used for building the prototype. The users of this prototype will have the capability to add or delete countries as they deem necessary, subject of course to the appropriate access privileges. Table 3-1 displays the data dictionary for the Country table.

Attribute	**Data Type**	**Description**
CountryName	Text (15)	Name of Country
Priority	Number (2)	Current Theater Priority
Leader	Text (30)	Name of the Country's Leader
GovtType	Text (Select)	Type of Government utilized by the Country

Table 3-1: Data Dictionary for Country Object

The second table, *Decision Maker*, contains a row for each person within a country who is a key player in his/her government's decision-making loop and whose decisions and actions may be influenced by certain media sources. Decision-makers will be the focus of any Information Operations conducted against a target country and information regarding all key decision-makers is highly important to the utility of the database. Table 3-2 displays the data dictionary for the table Decision-Maker.

Attribute	**Data Type**	**Description**
LName	Text (15)	Last Name of Decision-Maker
FName	Text (15)	First Name of Decision-Maker
Title	Text (15)	Title of Decision-Maker
Country	Text (25)	Decision-Makers Country

Table 3-2: Data Dictionary for Decision-Maker Object

The third table, *Media Source*, contains publications (such as a newspaper or magazine) or broadcasts (such as radio or television) that is utilized by key decision-makers in a country. The media source is what potentially can be used to perform theater Information Operations. Table 3-3 displays the data dictionary for the table Media Source.

Attribute	Data Type	Description
Name	Text (15)	Name of Media Source
Type	Text (Select)	Type of Media Source
Location	Text (15)	Location of Media Source
Periodicity	Text (Select)	Periodicity of Media Source
Ownership	Text (20)	Owner of Media Source

Table 3-3: Data Dictionary for Media Source Object

The fourth table, *Alliance*, captures recognized partnerships between two countries that should be taken into consideration when making Information Operations decisions. The data dictionary for the table alliance is shown in Table 3-4.

Attribute	Data Type	Description
Country	Text (25)	Name of Country
Ally	Text (25)	Name of Ally
Ally_Govt_Type	Text (Select)	Ally's type of government

Table 3-4: Data Dictionary for Alliance Object

The fifth table, *Affiliation*, represents understood relationships between countries and organizations that should also be taken into consideration when making Information Operations decisions. For example, if a country is affiliated with a certain kind of organization, this could effect how a theater CinC approaches a situation and

subsequently, his final decisions. The data dictionary for the table affiliation is shown in Table 3-5.

Attribute	Data Type	Description
Country	Text (25)	Name of Country
Affiliation	Text (25)	Name of Organization
AffliationType	Text (Select)	Type of Affiliation

Table 3-5: Data Dictionary for Affiliation Object

The final two tables, *Country_AffiliationGroup_X,* and *DecisionMaker_Media_Source_X* relate objects that have a many-to-many relationship. The attributes in these two tables exist in previously mentioned object tables and have already been described above.

These seven tables and their attributes form the database schema resulting from the requirements for ADMS. A complete data dictionary is provided in Appendix D.

E. CHAPTER CONCLUSION

Having created the database schema, ADMS is now ready for implementation. Forms will be created that will be used to populate the database. Queries that will serve as the foundation for the reports to users will be formally developed. These forms, queries, and reports will be the focus of Chapter IV.

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IV. DATABASE IMPLEMENTATION

A. INTRODUCTION

Once the database structure has been developed, the implementation of the database can begin. This implementation phase consists of creating forms that will help users input data, populating the database (in this case, using prototype data), developing queries that will poll and retrieve data, and finally creating reports in a format that conforms to the report requirements identified by users (see Chapter II). The results of ADMS implementation are contained in the following sections.

B. FORMS

Seven forms have been created to allow users to enter data into the seven tables developed in Chapter III. These forms contain text boxes where users can enter the information by typing or, in the case of drop-down boxes, selecting the appropriate data. Each of the forms has "add" and "delete" command buttons that, when selected, will add, update, or delete records from the relevant table. In addition, each form has a textbox to enter the "Date Last Updated." This information will be stored so that users will know how old records are. The created forms are shown in Figures 4-1 through 4-7.

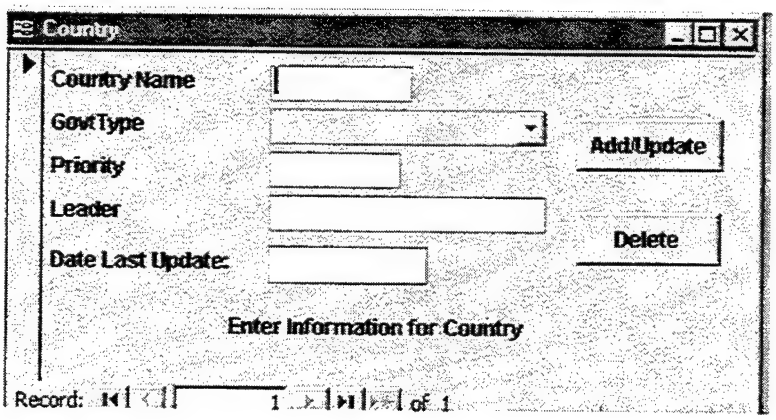


Figure 4-1: Country Form

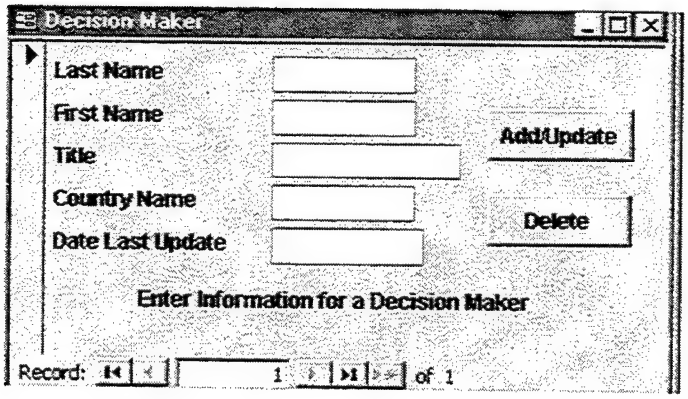


Figure 4-2: Decision-Maker Form

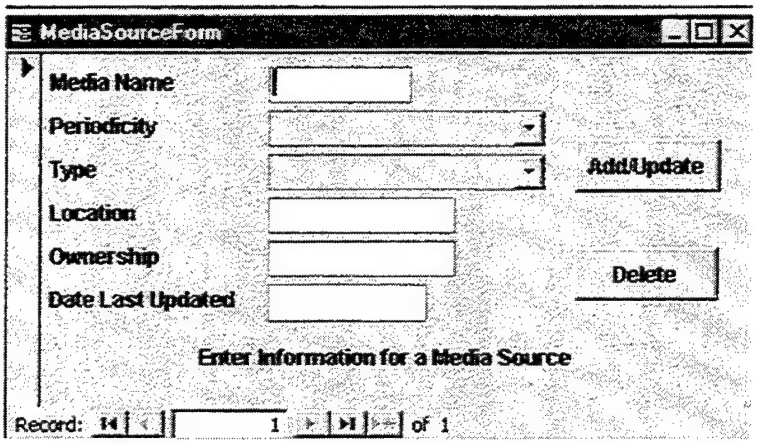


Figure 4-3: Media Source Form

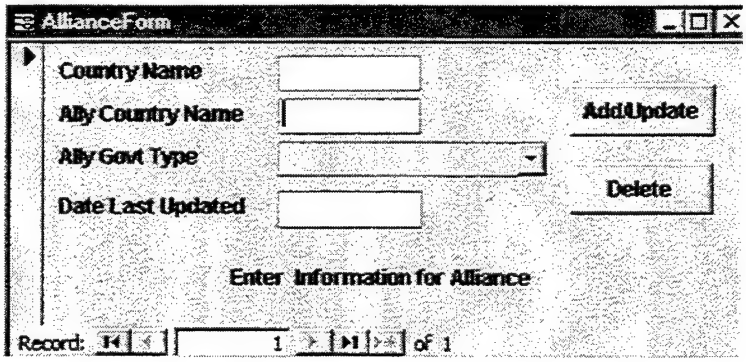


Figure 4-4: Alliance Form

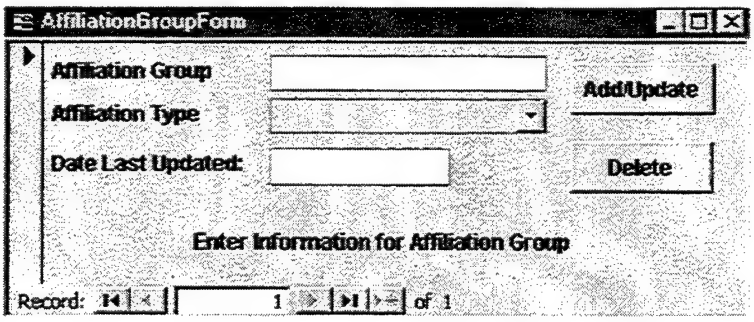


Figure 4-5: AffiliationGroup Form

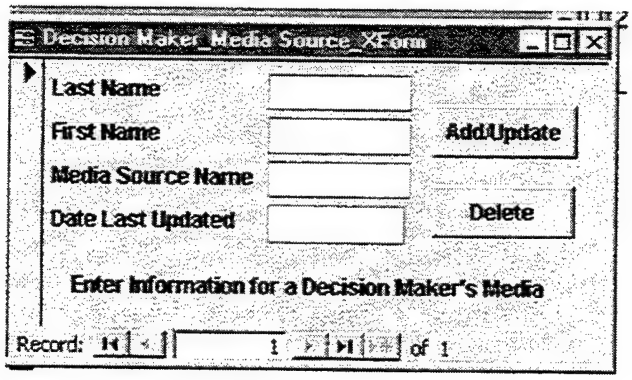


Figure 4-6: Decision-Makers Media Source Sub-Form

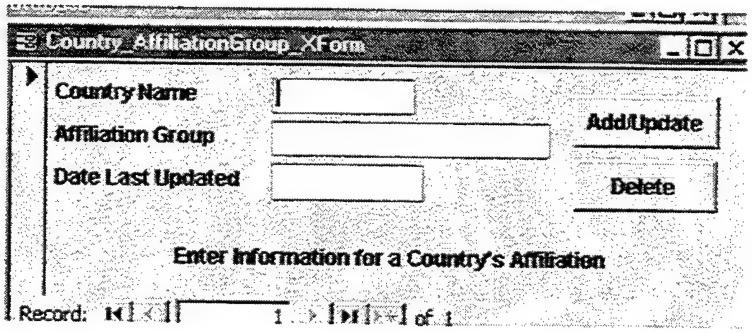


Figure 4-7: Country's Affiliations Form

In addition to the forms that are used to enter data into the database, forms will be included in system menus and sub-menus to allow the user to navigate through the ADMS and create a user-friendly environment. This 'switchboard menu system' will welcome users into ADMS displaying a menu with a list of options. These options will each lead to a sub-menu and, subsequently, will eventually lead to a form that will allow the user to add a record, edit a record, delete a record, or view a specified report. Some of these menus are shown in Figures 4-8 through 4-10.

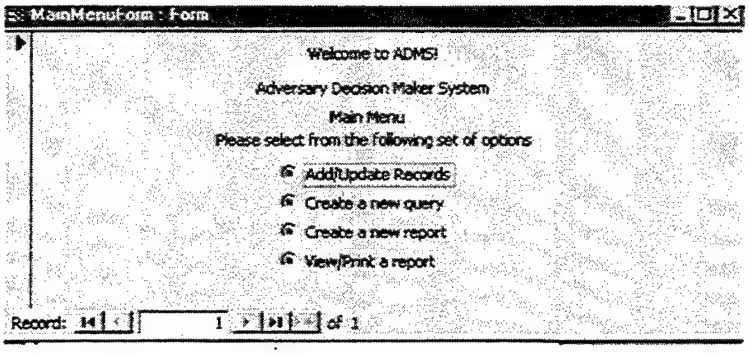


Figure 4-8: Main Menu Form

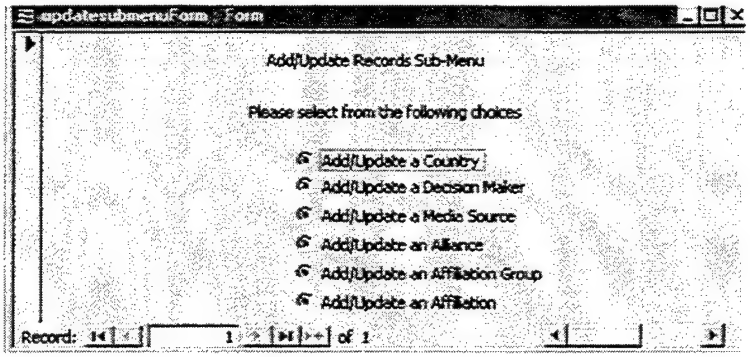


Figure 4-9: Add/Update Sub-Menu Form

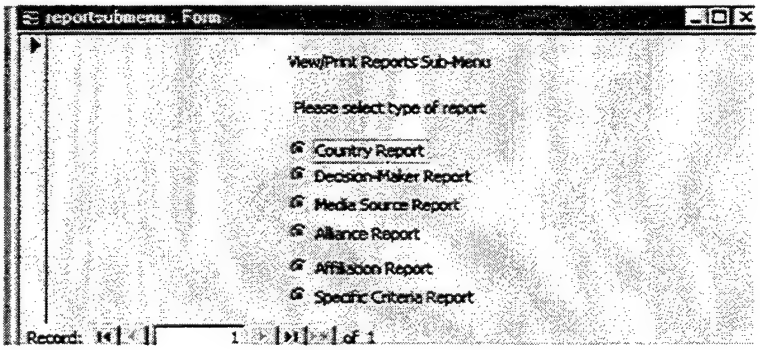


Figure 4-10: Reports Sub-Menu Form

C. POPULATING THE DATABASE

Now that forms have been created, the database can be populated with sample data creating a prototype to be used as a proof of concept. Using the forms created in the previous section, sample data was entered into each table. These tables containing the sample data are shown in Figures 4-8 through 4-14. All sample data is notional and does not represent official U.S. Government positions.

Country : Table

CountryName	GovtType	Priority	Leader
China	Communist	1	Jiang Zemin
India	Democracy	2	Kicheril Narayanan
Indonesia	Democracy	3	Abdurrahman Wahid
Japan	Socialist	4	Emperor Akihito
Russia	Democracy	5	Vladimir Putin
North Korea	Socialist	6	Kim Chong-Il

Figure 4-11: Country Table

Decision Maker : Table

DMId_LastName	DMId_FirstName	Title	Country_CountryName_FK
Akihito	Emperor	Emperor	Japan
Bangguo	Wu	Vice-Premier	China
Chong-Il	Kim	Chief of State	North Korea
Jiabao	Wen	Vice-Premier	China
Jintao	Hu	Vice-President	China
Kant	Krishnan	Vice-President	India
Kasyanov	Mikhail	Premier	Russia
Khristenko	Viktor	Deputy Premier	Russia
Klebanov	Ilya	Deputy Premier	Russia
Koshman	Nikolay	Deputy Premier	Russia
Kuzhugetovsky	Sergey	Deputy Premier	Russia
Lanqing	Li	Vice-Premier	China
Matviyenko	Valentina	Deputy Premier	Russia
Megawati	Rahmil	Vice-President	Indonesia
Mori	Yoshiro	Prime Minister	Japan
Narayanan	Kicheril	President	India
Putin	Vladimir	President	Russia
Qichen	Qian	Vice-Premier	China
Rongji	Zhu	Premier	China
Shcherbak	Vladimir	Deputy Premier	Russia
Song-Nam	Hong	Premier	North Korea
Vajpayee	Atal	Prime Minister	India
Wahid	Abdurrahman	President	Indonesia
Zemin	Jiang	President	China

Figure 4-12: Decision-Maker Table

Media Source : Table

MediaName	MediaPeriodicity	MediaType	MediaLocation	Ownership
BBC	hourly	radio	London	Big Ben
CNN	daily	television	Atlanta	Red Hot
CSPAN	daily	television	Chicago	The White Snow Co.
New York Times	daily	newspaper	New York	The Gray Brothers
Newsweek	weekly	magazine	New York	Black and White
US World Report	weekly	magazine	Los Angelos	Gold Mine
WABC	variable	radio	Miami	The Heat Group
Washington Post	daily	newspaper	Washington	The Blue Group
www.dowjone.com	hourly	web	New York	Green Backs
www.tech.com	variable	web	Boston	Red Sock

Figure 4-13: Media Source Table

Alliance : Table

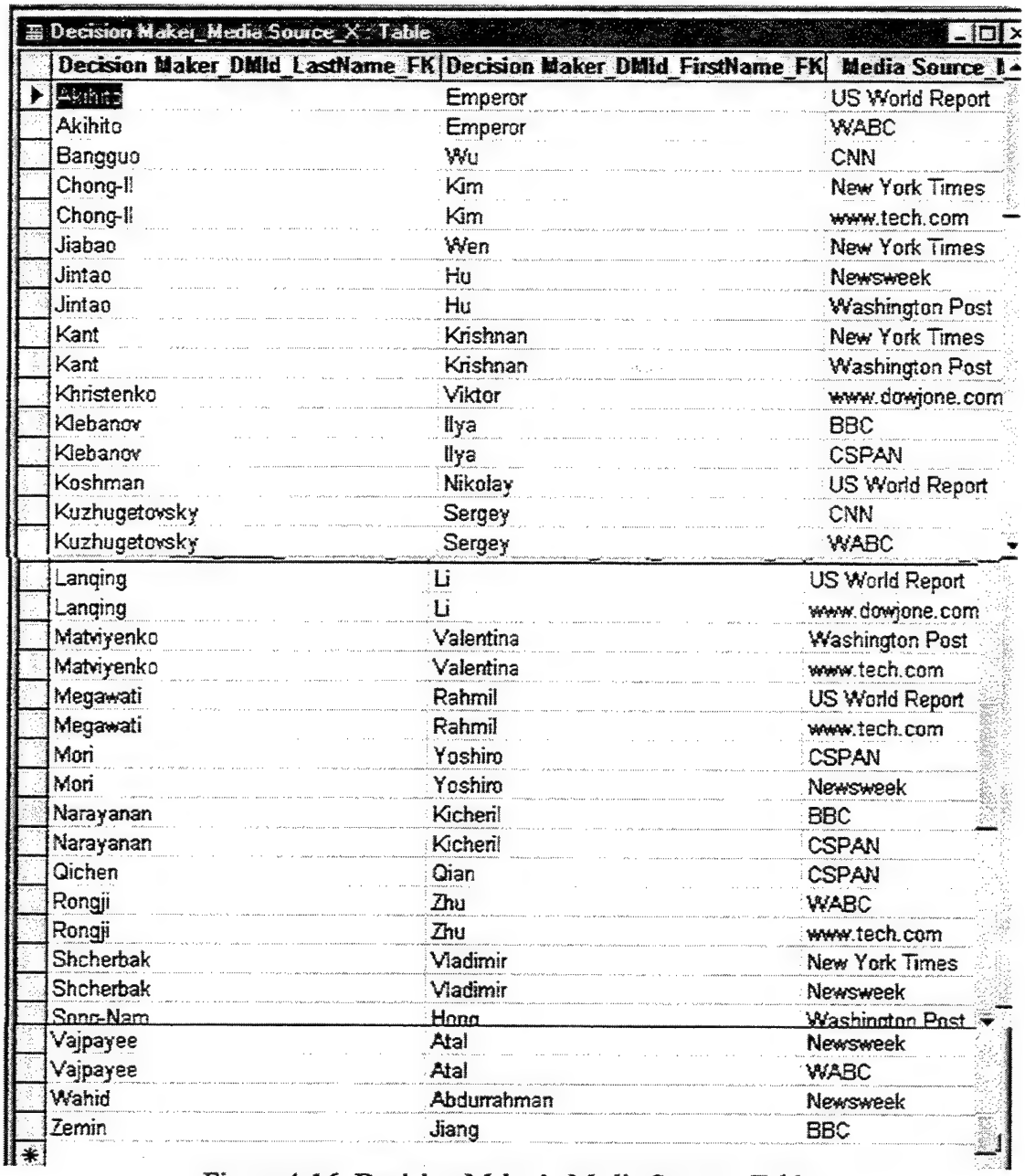
AllianceId_AllyCountry	AllianceId_Country_CountryName_FK	AllyGovtType
Bucapest	India	Democracy
Kazakhstan	Russia	Democracy
Lithuania	Russia	Democracy
Philippines	Japan	Socialist
Russia	China	Democracy
Saudi Arabia	India	Democracy
Singapore	Indonesia	Socialist
South Korea	Indonesia	Democracy
Thailand	China	Socialist
Turkey	North Korea	Socialist
United States	Japan	Democracy
Vietnam	North Korea	Communist

Figure 4-14: Alliance Table

AffiliationGroup : Table

AffiliationName	AffiliationType
Asian Anti-Terrorism Group	Trans-National
Chinese Reform Group	National
Communist Resurgence Board	Organizational
Eastern Asian Unification Org	Organizational
Former Soviet States	Trans-National
Indian Technology Association	National
Indonesian Relief Associates	National
Pacific Rim Organization	Organizational
Red Moon Group	Trans-National
Rising Sun Association	National
Russian Federation	National

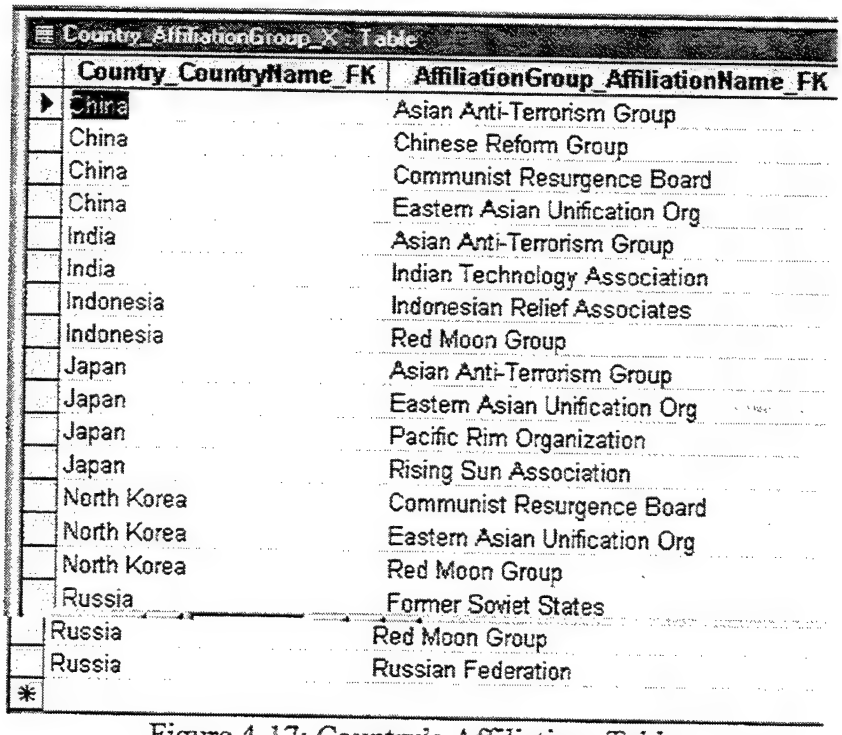
Figure 4-15: Affiliation Group Table



Decision Maker_Media Source_X : Table

Decision Maker_DMId_LastName_FK	Decision Maker_DMId_FirstName_FK	Media Source_I
Akihito	Emperor	US World Report
Akihito	Emperor	WABC
Bangguo	Wu	CNN
Chong-Il	Kim	New York Times
Chong-Il	Kim	www.tech.com
Jiabao	Wen	New York Times
Jintao	Hu	Newsweek
Jintao	Hu	Washington Post
Kant	Krishnan	New York Times
Kant	Krishnan	Washington Post
Khristenko	Viktor	www.dowjone.com
Klebanov	Ilya	BBC
Klebanov	Ilya	CSPAN
Koshman	Nikolay	US World Report
Kuzhugetovsky	Sergey	CNN
Kuzhugetovsky	Sergey	WABC
Lanqing	Li	US World Report
Lanqing	Li	www.dowjone.com
Matviyenko	Valentina	Washington Post
Matviyenko	Valentina	www.tech.com
Megawati	Rahmil	US World Report
Megawati	Rahmil	www.tech.com
Mori	Yoshiro	CSPAN
Mori	Yoshiro	Newsweek
Narayanan	Kicheril	BBC
Narayanan	Kicheril	CSPAN
Qichen	Qian	CSPAN
Rongji	Zhu	WABC
Rongji	Zhu	www.tech.com
Shcherbak	Vladimir	New York Times
Shcherbak	Vladimir	Newsweek
Song-Nam	Hong	Washington Post
Vajpayee	Atal	Newsweek
Vajpayee	Atal	WABC
Wahid	Abdurrahman	Newsweek
Zemin	Jiang	BBC

Figure 4-16: Decision Maker's Media Sources Table



Country_AffiliationGroup_X : Table

Country_CountryName_FK	AffiliationGroup_AffiliationName_FK
China	Asian Anti-Terrorism Group
China	Chinese Reform Group
China	Communist Resurgence Board
China	Eastern Asian Unification Org
India	Asian Anti-Terrorism Group
India	Indian Technology Association
Indonesia	Indonesian Relief Associates
Indonesia	Red Moon Group
Japan	Asian Anti-Terrorism Group
Japan	Eastern Asian Unification Org
Japan	Pacific Rim Organization
Japan	Rising Sun Association
North Korea	Communist Resurgence Board
North Korea	Eastern Asian Unification Org
North Korea	Red Moon Group
Russia	Former Soviet States
Russia	Red Moon Group
Russia	Russian Federation

Figure 4-17: Country's Affiliations Table

D. QUERIES AND REPORTS

Once the database has been populated, SQL queries can be directed to ADMS to retrieve data of interest to users. Database query objects in Access 2000 are written in Structured Query Language (SQL), a common database language similar to a programming language. The SQL statements tell Access which tables or queries you want to query (queries can also be queried since a query always creates a table), which fields you want returned as part of the answer, and which data selection operations should be performed as part of the query (i.e. – sorting, selection criteria, etc.) [Nelson, 93].

The queries developed for ADMS will yield the reports that users will want to see. There are well over a hundred queries needed to provide all of the ADMS reports. Thus, each query and report will not be shown here, but rather a sample of each type of

query and report. Using the queries, reports that will display the retrieved data in an easily understood format can be created. For each type of query, a sample report of the same type follows it. These queries and reports follow and are preceded by an explanation of what the query is asking in general terms.

The following query retrieves a list of all of the countries stored in ADMS along with attributes.

```
SELECT [CountryName], [GovtType], [Priority], [Leader]
FROM Country;
```

ADMS Report

All Countries

Priority	Country Name	Govt Type	Leader
1	China	Communist	Jiang Zemin
2	India	Democracy	Kicheril Narayanan
3	Indonesia	Democracy	Abdurrahman Wahid
4	Japan	Socialist	Emperor Akihito
5	Russia	Democracy	Vladimir Putin
6	North Korea	Socialist	Kim Chong-Il

The following query retrieves a list of all of the decision-makers stored in ADMS along with their attributes.

```
SELECT [DMId_LastName], [DMId_FirstName], [Title],
[Country_CountryName_FK]
FROM [Decision Maker];
```

ADMS Report

All Decision Makers

Country Name	LastName	FirstName	Title
China			
	Bangguo	Wu	Vice-Premier
	Jiabao	Wen	Vice-Premier
	Jintao	Hu	Vice-President
	Lanqing	Li	Vice-Premier
	Qichen	Qian	Vice-Premier
	Rongji	Zhu	Premier
	Zemin	Jiang	President
India			
	Kant	Krishnan	Vice-President
	Narayanan	Kicheril	President
	Vajpayee	Atal	Prime Minister
Indonesia			
	Megawati	Rahmil	Vice-President
	Wahid	Abdurrahman	President
Japan			
	Akihito	Emperor	Emperor
	Mori	Yoshiro	Prime Minister
North Korea			
	Chong-Il	Kim	Chief of State
	Song-Nam	Hong	Premier
Russia			
	Kasyanov	Mikhail	Premier
	Khristenko	Viktor	Deputy Premier
	Klebanov	Ilya	Deputy Premier
	Koshman	Nikolay	Deputy Premier
	Kuzhugetovsky	Sergey	Deputy Premier
	Matviyenko	Valentina	Deputy Premier
	Putin	Vladimir	President
	Shcherbak	Vladimir	Deputy Premier

The following query retrieves a list of all of the media sources stored in ADMS along with their attributes.

```
SELECT [MediaName], [MediaPeriodicity], [MediaType], [MediaLocation],
[Ownership]
FROM [Media Source];
```

ADMS Report

All Media Sources

Media Name	Periodicity	Type	Location	Ownership
BBC	hourly	radio	London	Big Ben
CNN	daily	television	Atlanta	Red Hot
CSPAN	daily	television	Chicago	The White Snow
New York Ti	daily	newspaper	New York	The Gray Brother
Newsweek	weekly	magazine	New York	Black and White
US World R	weekly	magazine	Los Angelos	Gold Mine
WABC	variable	radio	Miami	The Heat Group
Washington	daily	newspaper	Washington	The Blue Group
www.dowjon	hourly	web	New York	Green Backs
www.tech.co	variable	web	Boston	Red Sock

The following query retrieves a list of all of the alliances stored in ADMS along with their attributes.

```
SELECT [AllianceId_Country_CountryName_FK],
[AllianceId_AllyCountry], [AllyGovtType]
FROM Alliance;
```

ADMS Report

All Alliances

Country Name	Ally	Ally Govt Type
China		
	Russia	Democracy
	Thailand	Socialist
India		
	Budapest	Democracy
	Saudi Arabia	Democracy
Indonesia		
	Singapore	Socialist
	South Korea	Democracy
Japan		
	Philippines	Socialist
	United States	Democracy
North Korea		
	Turkey	Socialist
	Vietnam	Communist
Russia		
	Kazakhstan	Democracy
	Lithuania	Democracy

The following query retrieves a list of all affiliation groups stored in ADMS along with their attributes.

```
SELECT [AffiliationName], [AffiliationType]
FROM AffiliationGroup;
```

ADMS Report

All Affiliations

Affiliation Name	Affiliation Type
Asian Anti-Terrorism Group	Trans-National
Chinese Reform Group	National
Communist Resurgence Boar	Organizational
Eastern Asian Unification Org	Organizational
Former Soviet States	Trans-National
Indian Technology Association	National
Indonesian Relief Associates	National
Pacific Rim Organization	Organizational
Red Moon Group	Trans-National
Rising Sun Association	National
Russian Federation	National

The following query retrieves a list of all affiliations of a given country along with their attributes.

```
SELECT AffiliationGroup.AffiliationName,
AffiliationGroup.AffiliationType
FROM AffiliationGroup INNER JOIN Country_AffiliationGroup_X ON
AffiliationGroup.AffiliationName =
Country_AffiliationGroup_X.AffiliationGroup_AffiliationName_FK
WHERE (((Country_AffiliationGroup_X.Country_CountryName_FK)=
[CountryName: ]))
ORDER BY AffiliationGroup.AffiliationName;
```

ADMS Report

All Indian Alliances

Ally	Govt Type
Budapest	Democracy
Saudi Arabia	Democracy

The following query retrieves a list of all alliances of a given country along with their attributes.

```
SELECT [Alliance].[AllianceId_AllyCountry], [Alliance].[AllyGovtType]
FROM Alliance
WHERE
((([Alliance].[AllianceId_Country_CountryName_FK])=[CountryName: ]))
ORDER BY [Alliance].[AllianceId_AllyCountry];
```

ADMS Report

All Japanese Affiliations

Affiliation Name	Affiliation Type
Asian Anti-Terrorism Group	Trans-National
Eastern Asian Unification Org	Organizational
Pacific Rim Organization	Organizational
Rising Sun Association	National

The following query retrieves a list of a given country's decision-makers along with their attributes.

```
SELECT [Decision Maker].DMId_LastName, [Decision
Maker].DMId_FirstName, [Decision Maker].Title
FROM [Decision Maker]
WHERE
((([Decision Maker].Country_CountryName_FK)=[CountryName: ))
ORDER BY [Decision Maker].DMId_LastName;
```

ADMS Report

All Indonesian Decision-Makers

Last Name	First Name	Title
Megawati	Rahmil	Vice-President
Wahid	Abdurrahman	President

The following query retrieves a list of all media sources used by a given country along with their attributes.

```
SELECT [Media Source].MediaName, [Media Source].MediaPeriodicity,
[Media Source].MediaType, [Media Source].MediaLocation
FROM [Media Source] INNER JOIN ([Decision Maker] INNER JOIN
[Decision Maker_Media Source_X] ON ([Decision Maker].DMId_FirstName
= [Decision Maker_Media Source_X].[Decision
Maker_DMId_FirstName_FK]) AND ([Decision Maker].DMId_LastName =
[Decision Maker_Media Source_X].[Decision
Maker_DMId_LastName_FK])) ON [Media Source].MediaName = [Decision
Maker_Media Source_X].[Media Source_MediaName_FK]
WHERE
((([Decision Maker].Country_CountryName_FK)=[CountryName: ]))
ORDER BY [Media Source].MediaName;
```

ADMS Report

All Media Sources used by Russia

MediaName	Periodicity	Type	Location
CSPAN	daily	television	Chicago
Newsweek	weekly	magazine	New York
US World Rep	weekly	magazine	Los Angelos
WABC	variable	radio	Miami

The following query retrieves a list of all decision-makers who use a given media source along with their attributes.

```
SELECT [Decision Maker].DMId_LastName, [Decision
Maker].DMId_FirstName, [Decision Maker].Title, [Decision
Maker].Country_CountryName_FK
FROM [Decision Maker] INNER JOIN [Decision Maker_Media Source_X]
ON ([Decision Maker].DMId_FirstName = [Decision Maker_Media
Source_X].[Decision Maker_DMId_FirstName_FK]) AND ([Decision
Maker].DMId_LastName = [Decision Maker_Media Source_X].[Decision
Maker_DMId_LastName_FK])
WHERE ((([Decision Maker_Media Source_X].[Media
Source_MediaName_FK])=[MediaName: ]))
ORDER BY [Decision Maker].DMId_LastName;
```

ADMS Report

All Decision-Makers who use CNN

Country Name	Last Name	First Name	Title
China			
	Bangguo	Wu	Vice-Premier
Russia			
	Kuzhugetovsky	Sergey	Deputy Premier

The following query retrieves a list of all alliances with a specific government type of a given country along with their attributes.

```
SELECT [JapanAlliancesQuery].[AllianceId_AllyCountry]
FROM JapanAlliancesQuery
WHERE ((([JapanAlliancesQuery].[AllyGovtType])=[GovtType: ]))
ORDER BY [JapanAlliancesQuery].[AllianceId_AllyCountry];
```

ADMS Report

All Democratic Alliances for Japa

Ally

United States

The following query retrieves a list of a given country's affiliations of a specific type along with their attributes.

```
SELECT [IndiaAffiliations].[AffiliationName]
FROM IndiaAffiliations
WHERE ((([IndiaAffiliations].[AffiliationType])=[AffiliationType: ]))
ORDER BY [IndiaAffiliations].[AffiliationName];
```

ADMS Report

All Indian Affiliations

Affiliation Name

Indian Technology Association

The following query retrieves a list of a given country's decision-makers who use a specific media source along with their attributes.

```
SELECT [AllNewsweekDM's].[DMId_LastName],
[AllNewsweekDM's].[DMId_FirstName], [AllNewsweekDM's].[Title]
FROM [AllNewsweekDM's]
WHERE

((([AllNewsweekDM's].[Country_CountryName_FK])=[CountryName: ]))
```

ADMSReport

All Decision-Makers in China who use Newswee

Last Name	First Name	Title
Jintao	Hu	Vice-President

Users can retrieve certain information from ADMS and then ask more specific questions (through queries) to further 'drill-down' into the data. For example, a user may want to see all decision-makers in India. Of that list the user may ask to see which use a printed media source (magazine or newspaper). Of that list the user may then want to see which use newspapers. Finally, a user could poll the last query to find out which use either the Washington Post or the Chicago Tribune. For drill-down queries, the following dimensions are relevant and can be defined further through hierarchies:

- Media source
- Government type
- Affiliation type

Each of these dimensions can be broken down into the following hierarchical structures shown in Figures 4-15 through 4-17:

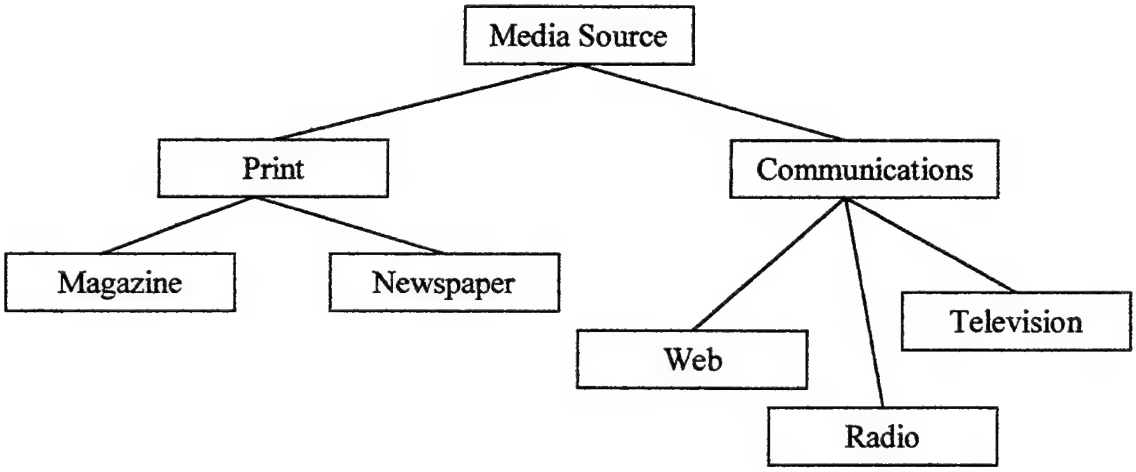


Figure 4-18: Media Source Hierarchy

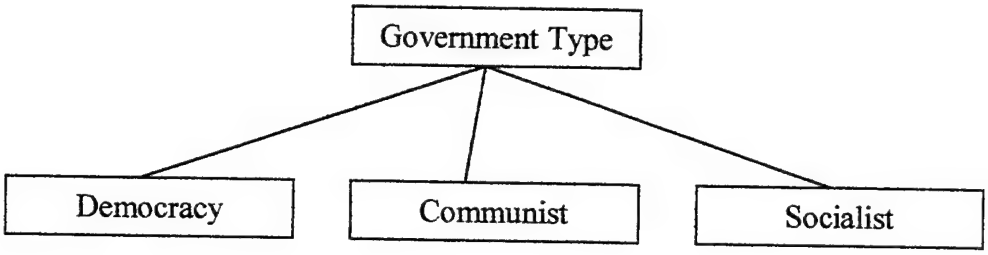


Figure 4-19: Government Type Hierarchy

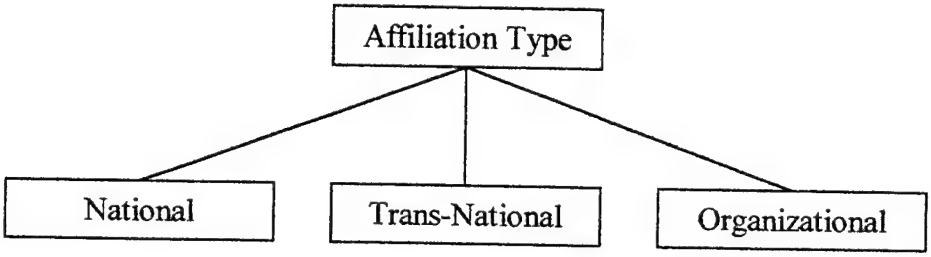


Figure 4-20: Affiliation Type Hierarchy

Using these drill-down dimensions, a query can be structured to retrieve, as an example, the number of decision-makers in each country who use print media and communications media. A sample table reflecting this retrieval is shown in Table 4-1.

	Print	Comms	Total
China	21	35	56
India	17	31	48
Indonesia	11	18	29
Japan	41	38	79
North Korea	12	19	31
Russia	54	67	121
Total	156	208	364

Table 4-1: Drill-down Sample

The user could then drill down by print media to see how many decision-makers use magazines and newspapers. A sample table is shown in Table 4-2.

	Magazines	Newspapers	Total
China	10	11	21
India	9	8	17
Indonesia	7	4	11
Japan	17	24	41
North Korea	6	6	12
Russia	23	31	54
Total	72	84	156

Table 4-2: Drill-down Sample

E. DATABASE ADMINISTRATION ISSUES

Because ADMS will store highly sensitive data, certain database administration issues need to be addressed. These issues include Security and Recovery/Backup. The main concern with security is ensuring that only those users with the appropriate clearance and need-to-know will be able to access/manipulate information contained in ADMS. As mentioned in Chapter II, passwords and data encryption are two measures that can be taken to provide additional security. With respect to Recovery/Backup, the concern is to ensure the system can be restored if it is completely or partially destroyed. Replication is a feature that allows a database to be copied into a backup file and subsequently recovered if necessary. These features, provided in Access 2000, will be briefly discussed in the following paragraphs.

Access provides a password feature that restricts access to the database until a valid password is entered. Whenever the database is opened, a dialogue box that requests

the password is displayed and the user cannot access the database until a valid password is entered. The password is encrypted so that it cannot be accessed by anyone reading the database file. Once the database is opened, the user has access to all objects and functions within the system. Access can also encrypt the database making it indecipherable to unauthorized users. Only authorized users will have the ability to decrypt the database and view its contents.

A complete backup copy of ADMS should be made anytime there are changes to the database in case of tampering or physical destruction of the system. With a backup copy, the system can be fully restored. Additionally, if the database behaves unpredictably, it may be damaged. Access has a Repair Database feature under the Database Utilities tool.

F. CHAPTER SUMMARY

The completion of the implementation phase brings an end to the development cycle of the database. The system has now been designed and subsequently proven to be capable of meeting all of the requirements discussed in Chapter III. It is envisioned that the ADMS system will also include one or more decision support tools that will analyze the data contained in the database to help users make operational decisions. Suggestions for implementation of decision support capabilities are discussed in the next chapter.

V. DECISION SUPPORT FOR ADMS

A. INTRODUCTION

As stated earlier it is envisioned that ADMS will not only be composed of the database developed in this thesis, but also will integrate various decision support tools to analyze the database information and help users make better informed decisions. The actual decision support system will be developed in a follow-on project. Here, as the final part of this project, a suggestion for integrating the decision support tool called SIAM will be proposed as a starting block for the developers of the follow-on decision support system. The proposal will follow a brief review of decision support systems as well as a brief overview of the SIAM tool.

B. DECISION SUPPORT TECHNOLOGY

A decision support system couples the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer-based support system for management decision-makers who deal with semi-structured problems [Turban, 13].

There are many different types of decision support tools. Knowledge-based Systems, Expert Systems, Artificial Intelligence, Data Mining, Neural Networks, Genetic Algorithms, and Intelligent Agents are a few of the various decision technologies. Some have been around for a number of years and are more commonly used while others are new technologies that are still proving their utility today. The selection of the appropriate type of decision support tool is primarily dependent on what requirements users have for

analysis. For ADMS, it is inherently obvious that the concern is how decision-makers are influenced. Consequently, the influence diagram is a reasonable choice as a type of decision support tool to be used with ADMS. Since Influence networks are an appropriate selection and because follow-on work is already in progress using an influence networking decision support tool known as Situational Influence Assessment Module (SIAM), it is recommended that SIAM be used with ADMS. An overview of SIAM is provided in the following section.

C. SITUATIONAL INFLUENCE ASSESSMENT MODULE (SIAM)

SIAM is an automated decision support tool that implements the principle of Influence Net modeling (see Influence Diagrams, Chapter II). Influence Net modeling, or Influence diagrams, allows users to construct graphical representations of complex, cause-and-effect relationships involving uncertainty [Sands, 1]. These networks can be used to identify those important issues, actions, or factors that have the potential for influencing a specific outcome in a given situation. SIAM is used to provide a quick analysis of causal relationships in the following ways: 1) Help give structure to a problem, 2) Identify the various elements that come into play, and 3) Explore how those elements interact via "what if" analysis. As an example, when a theater CinC is planning Information Operations and wants to affect the outcome of a situation, SIAM can be used to identify the primary factors that could possibly influence the situation towards a favorable outcome.

The first step is to construct the influence network and then, once this is done, "what if" analysis can be conducted to examine the possible effects that certain actions

will have on the outcome. Unintended consequences can also be identified. SIAM can show how a small change in one event can affect the entire net. Thus, SIAM essentially highlights the links that could change the outcome of a scenario.

A SIAM influence network is developed by first identifying a *root node*. This root node constitutes the ultimate goal or outcome of a situation. Secondly, nodes that have immediate causal effect on the root node are identified. These *immediate causal nodes* have a direct effect on the root node and may also affect other nodes in the network. It is important to note here that influence diagrams are probabilistic models and there are uncertainties and probabilities associated with each causal effect. The network expands until all possible influences on each node have been included. *Causal nodes* are nodes that do not directly affect the root node, but affect it indirectly through other nodes. *Initial causal nodes* are nodes that affect other nodes but are not affected themselves. Initial nodes can be thought of as the start of a series of chain reactions (influenced events) that ultimately lead to the root node through a set of intermediate nodes [Sands, 2]. Figure 5-1 depicts an influence network that reinforces these concepts.

Just as it is important to understand what SIAM is, it is equally important to understand what SIAM is not. SIAM is a tool; it is not a solution. SIAM is not a substitute for judgment. It is possible, however, to capture expert judgment in it. In fact, the ability to capture expertise and keep it up to date is one of the valuable benefits of using SIAM. It must be underscored that this tool is very useful for exploring alternatives, and as the situation changes, users must update the model to reflect those changes [Sands, 10].

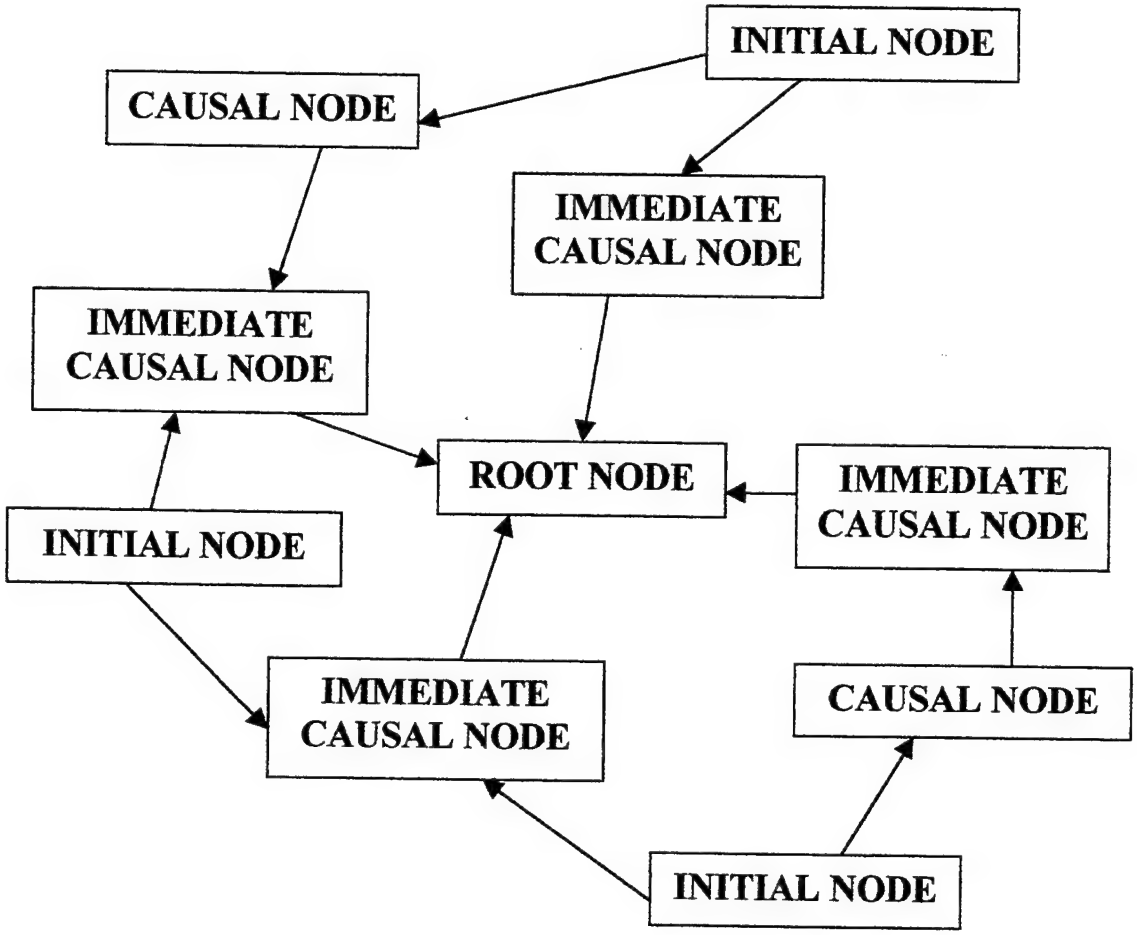


Figure 5-1: Influence Network Diagram

D. DATABASE AND DECISION SUPPORT INTEGRATION

As indicated in the introduction of this chapter, ADMS is envisioned to consist of not only the database developed in Chapter III, but also an integrated decision support tool (SIAM). The integration of these two systems will be performed as follow-on to this project. This section provides a suggested point of origin on how to go about building the SIAM architecture using the database developed here. The SIAM portion of ADMS

will actually consist of a set of influence networks. Each country listed in the ADMS database will have an influence network summarizing the structure of the events, people, and media sources that have an influence on decision-makers and, ultimately, the top-level decision-maker.

The top-level decision-maker will be the root node for each countries influence network diagram. Everything that directly influences the top-level decision-maker (i.e. his advisors, events, media sources) will branch off of and point to the root node. These direct influences will become immediate causal nodes. From here, we continue to back down the "chain" so to speak repeating these steps for each node creating intermediate and, eventually, initial causal nodes. When all nodes have been expanded to the full extent and all paths begin with an initial causal node, the influence network is complete. It is important to note here that information on countries, decision-makers, media sources, alliances, and affiliations will come from the ADMS database. Any extraneous information that has an influence in the network schema will have to be provided by a separate source or entered individually. Figure 5-2 shows a sample of a simple influence network diagram using data from the ADMS prototype created in Chapter IV.

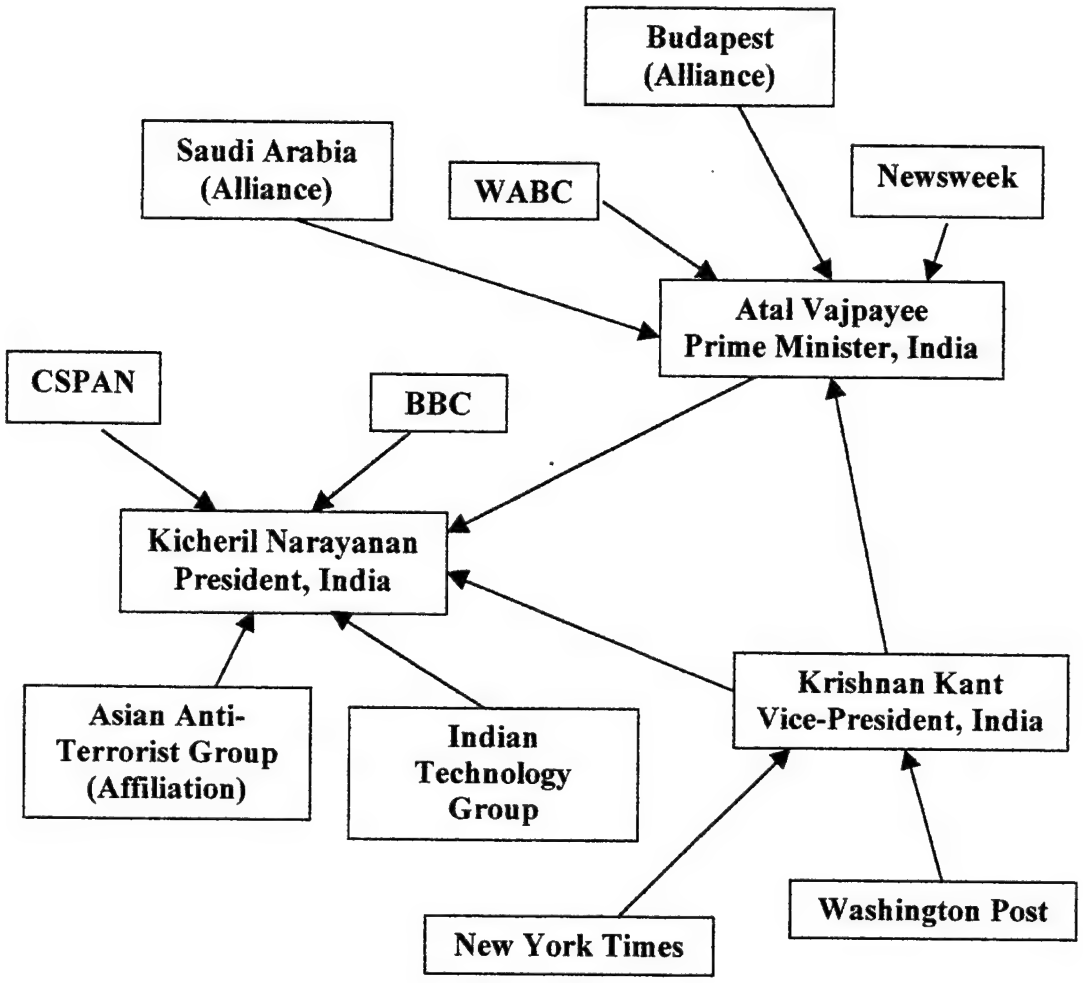


Figure 5-2: Influence Network Sample

When a SIAM model is being designed for a particular country, the ADMS database should feed the model appropriate information to aide in the setup. The root node should be established by selecting the appropriate country from a list of countries stored in the database. Any media sources directly tied to the country's leader should automatically be placed in the model as immediate causal influences. Each decision-

maker stored in the ADMS database for that particular country should then be placed in the model and the model's designer will have to create the influence links showing what decision-makers influence other decision-makers. Each decision-maker's media sources are automatically placed in the model. Similarly, each alliance and affiliation associated with this particular country should be placed in the model and the model's designer will have to insert the appropriate links as to which decision-makers are influenced by these alliances and affiliations. In general, once an abstract template has been generated, a Visual Basic program, or equivalent, can be written to query ADMS and automatically populate the SIAM model.

E. CHAPTER SUMMARY

Using the previous section as a foundation for the development of an integrated decision support tool incorporated with the ADMS database, development can begin on a the decision support portion of ADMS using SIAM. Once the ADMS database has been populated with real data, decision support developers can use this framework to begin building the influence networks for each country. The decision support portion of ADMS will be a very important piece in making the ADMS system fully functional in meeting the objectives for which it was designed.

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VI. CONCLUSION AND RECOMMENDATIONS

A. CONCLUSION

This thesis has shown how a useful database for theater commanders can be built that meets all stated requirements and will provide the data for part of their Information Operations processes. The ADMS database was designed using Commercial Off-the-Shelf (COTS) technology, which avoids the complexities of having to use non-COTS software/equipment. The database was built in a general way that allows it to be used not just by USPACOM, but by other theater CinCs as well. In addition, a framework was proposed for integrating the ADMS database with a decision support tool called SIAM which would augment the database with the capability to do detailed influence analysis.

B. RECOMMENDATIONS

This thesis provides a foundation for other potential projects to build upon. After having completed this initial ADMS prototype, the following recommendations are made:

- USPACOM should immediately begin populating the ADMS database with real data and begin using it as a functional resource to prove its value to other interested parties.

- The ADMS should be introduced to all theater CinCs and they should be given the opportunity to populate the ADMS with data from their respective theaters.

- The suggested framework for the decision support portion of ADMS should be implemented to enhance the value of the system to decision-makers. Customer data collection and subsequent database population will be a key factor in the ability for decision support developers to complete this aspect of system development.

- With a working system in hand, USPACOM and other theater CinCs can provide additional feedback and suggest incremental enhancements to ensure they will get a final product that evolves to their full requirements.

- Once theater CinCs are satisfied with the ADMS, a contractor can be hired to build the final product using the blueprints developed here and in follow-on projects, and incorporating any changes as mandated by the customer.

APPENDIX A: OBJECT SUMMARIES

Object Summary

Model: Adms

COUNTRY Object

Caption:
Description:

Data Item:

Item Name	ID Type	Min	Max	Value Type	Len	Initial Value	Edit Permission	Source
CountryName	Unique	1	1	Text	15		Change	User
Leader	None	0	1	Text	30		Change	User
Priority	None	0	1	Small Whole Number (± 127)			Change	User
GovtType	None	1	1	Text	15		Change	User
Decision Maker	None	1	N	Object				
Alliance	None	0	N	Object				
AffiliationGroup	None	0	N	Object				

Object Summary

Model: Adms

DECISION MAKER Object

Caption:
Description:

Data Item:

Item Name	ID Type	Min	Max	Value Type	Len	Initial Value	Edit Permission	Source
DMId	Unique	1	1	Group				
LastName	None	1	1	Text	15		Change	User
FirstName	None	1	1	Text	15		Change	User
Title	None	0	1	Text	20		Change	User
Country	None	1	1	Object				
Media Source	None	0	N	Object				

Object Summary

Model: Adms

MEDIA SOURCE Object

Caption:
Description:

Data Item:

Item Name	ID Type	Min	Max	Value Type	Len	Initial Value	Edit Permission	Source
MediaName	Unique	1	1	Text	15		Change	User
MediaType	None	1	1	Text	15		Change	User
MediaLocation	None	0	1	Text	20		Change	User
MediaPeriodicity	None	0	1	Text	15		Change	User
Ownership	None	0	1	Text	20		Change	User
Decision Maker	None	0	N	Object				

Object Summary

Model: Adms

ALLIANCE Object

Caption
Description

Data Item:

Item Name	ID Type	Min	Max	Value Type	Len	Initial Value	Edit Permission	Source
AllianceId	Unique	1	1	Group				
Country	None	1	1	Object				
AllyCountry	None	1	1	Text	15		Change	User
AllyGovtType	None	0	1	Text	15		Change	User

Object Summary

Model: Adms

AFFILIATIONGROUP Object

Caption:
Description:

Data Item:

Item Name	ID Type	Min	Max	Value Type	Len	Initial Value	Edit Permission	Source
AffiliationName	Unique	1	1	Text	30		Change	User
AffiliationType	None	1	1	Text	15		Change	User
Country	None	0	N	Object				

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APPENDIX B: TABLE SUMMARIES

Table Summary

Model: Adms

"Decision Maker" Table

Source Object or Item: Decision Maker Object

Column Name	Data Type	Length	Null Allowed	Object Item Name	Index
Country_CountryName_FK	Text	15	No	ForeignKey	
DMId_FirstName	Text	15	No	Decision Maker.DMId. FirstName	(DMId_LastName, DMId_FirstName) PrimaryKey
DMId_LastName	Text	15	No	Decision Maker.DMId. LastName	(DMId_LastName, DMId_FirstName) PrimaryKey
Title	Text	20	Yes	Decision Maker.Title	

Table Summary

Model: Adms

"Decision Maker_Media Source_X" Table

Source Object or Item: Media Source Decision Maker Item

Column Name	Data Type	Length	Null Allowed	Object Item Name	Index
"Decision Maker_DMId_ FirstName_FK"	Text	15	No	ForeignKey	("Decision Maker_ DMId_LastName_ FK", "Decision Maker_DMId_ FirstName_FK", "Media Source_ MediaName_FK") PrimaryKey
"Decision Maker_DMId_ LastName_FK"	Text	15	No	ForeignKey	("Decision Maker_ DMId_LastName_ FK", "Decision Maker_DMId_ FirstName_FK", "Media Source_ MediaName_FK") PrimaryKey
"Media Source_MediaName_FK"	Text	15	No	ForeignKey	("Decision Maker_ DMId_LastName_ FK", "Decision Maker_DMId_ FirstName_FK", "Media Source_ MediaName_FK") PrimaryKey

Table Summary

Model: Adms

"Media Source" Table

Source Object or Item: Media Source Object

Column Name	Data Type	Length	Null Allowed	Object Item Name	Index
MediaLocation	Text	20	Yes	Media Source.MediaLocation	
MediaName	Text	15	No	Media Source.MediaName	PrimaryKey
MediaPeriodicity	Text	15	Yes	Media Source. MediaPeriodicity	
MediaType	Text	15	No	Media Source.MediaType	
Ownership	Text	20	Yes	Media Source.Ownership	

Table Summary

Model: Adms

AffiliationGroup Table

Source Object or Item: AffiliationGroup Object

Column Name	Data Type	Length	Null Allowed	Object Item Name	Index
AffiliationName	Text	30	No	AffiliationGroup. AffiliationName	PrimaryKey
AffiliationType	Text	15	No	AffiliationGroup.AffiliationType	

Table Summary

Model: Adms

Alliance Table

Source Object or Item: Alliance Object

Column Name	Data Type	Length	Null Allowed	Object Item Name	Index
AllianceId_AllyCountry	Text	15	No	Alliance.AllianceId.AllyCountry	(AllianceId_ AllyCountry, AllianceId_ Country_ CountryName_ FK) PrimaryKey
AllianceId_Country_ CountryName_FK	Text	15	No	ForeignKey	(AllianceId_ AllyCountry, AllianceId_ Country_ CountryName_ FK) PrimaryKey
AllyGovtType	Text	15	Yes	Alliance.AllyGovtType	

Table Summary

Model: Adms

Country Table

Source Object or Item: Country Object

Column Name	Data Type	Length	Null Allowed	Object Item Name	Index
CountryName	Text	15	No	Country.CountryName	PrimaryKey
GovtType	Text	15	No	Country.GovtType	
Leader	Text	30	Yes	Country.Leader	
Priority	Small Whole Number (± 127)		Yes	Country.Priority	

Table Summary

Model: Adms

Country_AffiliationGroup_X Table

Source Object or Item: AffiliationGroup.Country Item

Column Name	Data Type	Length	Null Allowed	Object Item Name	Index
AffiliationGroup_AffiliationName_FK	Text	30	No	ForeignKey	(Country_CountryName_FK, AffiliationGroup_AffiliationName_FK) PrimaryKey
Country_CountryName_FK	Text	15	No	ForeignKey	(Country_CountryName_FK, AffiliationGroup_AffiliationName_FK) PrimaryKey

APPENDIX C: TABLE RELATIONSHIPS

Table Relationships

Model: Adms

Table	Relationship Type	Mandatory	Related Table	Foreign Key Relationships
"Decision Maker"	N:1	Yes	Country	Country_CountryName_FK matches CountryName
	1:N	No	"Decision Maker_ Media Source_X"	(DMId_FirstName, DMId_LastName) matches ("Decision Maker_DMId_FirstName_FK", "Decision Maker_DMId_LastName_FK")
"Decision Maker_ Media Source_X"	N:1	Yes	"Decision Maker"	("Decision Maker_DMId_LastName_FK", "Decision Maker_DMId_FirstName_FK") matches (DMId_ LastName, DMId_FirstName)
	N:1	Yes	"Media Source"	"Media Source_MediaName_FK" matches MediaName
"Media Source"	1:N	No	"Decision Maker_ Media Source_X"	MediaName matches "Media Source_MediaName_ FK"
AffiliationGroup	1:N	No	Country_ AffiliationGroup_X	AffiliationName matches AffiliationGroup_ AffiliationName_FK
Alliance	N:1	Yes	Country	AllianceId_Country_CountryName_FK matches CountryName
Country	1:N	Yes	"Decision Maker"	CountryName matches Country_CountryName_FK
	1:N	No	Alliance	CountryName matches AllianceId_Country_ CountryName_FK
	1:N	No	Country_ AffiliationGroup_X	CountryName matches Country_CountryName_FK
Country_ AffiliationGroup_X	N:1	Yes	Country	Country_CountryName_FK matches CountryName
	N:1	Yes	AffiliationGroup	AffiliationGroup_AffiliationName_FK matches AffiliationName

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APPENDIX D: ADMS DATA DICTIONARY

Attribute	Data Type	Description
CountryName	Text (15)	Name of Country
Priority	Number (2)	Current Theater Priority
Leader	Text (30)	Name of the Country's Leader
GovtType	Text (Select)	Type of Government utilized by the Country
LName	Text (15)	Last Name of Decision-Maker
FName	Text (15)	First Name of Decision-Maker
Title	Text (15)	Title of Decision-Maker
MediaName	Text (15)	Name of Media Source
MediaType	Text (Select)	Type of Media Source
MediaLocation	Text (15)	Location of Media Source
MediaPeriodicity	Text (Select)	Periodicity of Media Source
Ownership	Text (20)	Owner of Media Source
AllyCountry	Text (25)	Name of Ally
AllyGovtType	Text (Select)	Ally's type of government
AffiliationName	Text (25)	Name of Organization
AffliationType	Text (Select)	Type of Affiliation

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